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30.03.2022

Cruise report

FRV „Clupea“

Cruise 367,

29.08.-02.09.2022

Cruise leader: Dr. Jörn Peter Scharsack

CONMAR-Fish Effects of marine dumped munition on fish in the North Sea

Summary

The cruise was performed to investigate if fish in the North Sea in the area around Helgoland are affected by munition compounds (MC) leaking from marine dumped munitions. The cruise aimed to test if beam trawls in close proximity to munition dumping sites would yield sufficient numbers of flat fish for sampling. Additionally, angling was tested, right above dumped munitions since operation of fishing gear with seafloor contact, such as beam trawls, is impossible on munition dump sites. Main target species was the bottom dwelling flat fish, common dab (*Limanda limanda*), since they live relatively stationary. The operation of the beam trawl for flat fish in the target area (Tiefe Rinne, south west of Helgoland) was problematic, after only 15 min trawling, the net was filled with oyster shells, which ripped open the net. Angling at Tiefe Rinne (54m depth) did not yield any fish. With the replacement net, trawling westerly to Helgoland also revealed seafloor situations with lots of oyster shells and no dab. Only further North west of Helgoland, we were successfully collecting dab which were sampled. Angling was also performed at the dumping area East of Helgoland, named 'Steingrund'. Here, flatfish were not hoked, but mackerel, cod and whiting, which were used for sampling.

Background

During and after WW I and II huge amounts of munition were dumped in the North Sea (approx. 1.3 mio t). Due to corrosion munition compounds (MC), such as explosives are leaking into the marine environment, which might have negative effects on biota, including fish. Helgoland was a military harbour and fortification during WWII and was bombed heavily by allied forces. After the war, the areas Steingrund (East of Helgoland) and Tiefe Rinne (South from Helgoland) were used as munition dump sites. The present cruise was performed in frame of the project CONMAR in the BMBF DAM mission SustainMare, which aims to compile information on marine dumped munitions in German coastal waters, with the aim to develop strategies for clearance measures. Furthermore, collected information will be used for a screening of the marine munition problem requested by the German Conference of Environment Ministers. The present cruise aimed to sample in two areas with marine dumped munition in the area around Helgoland, namely the Tiefe Rinne and Steingrund to address the hypotheses that flatfish (and other fish) living in proximity to marine dumped munition take up leaking MC and might be altered by those with respect to their health.

Methodology

Selection of sampling sites

Directly at marine munition dumping sites, use of heavy fishing gear with ground contact is not possible, due to the risk of collecting munition which might still be fused and explosive or harmful in other ways. The present cruise therefore planned to test two methodologies to collect fish. A 3m beam trawl with a flatfish net was used in the surrounding of munition dump sites. This was facilitated by contact to local fisherman, who could advise the captain on areas (Schleppstriche) near the Tiefe Rinne dumpsite, which were free of dumped munition. Secondly, angling was planned right above the dumped munition at Tiefe Rinne and Steingrund. At Steingrund, usage of a beam trawl is anyways impossible, due to the stony seafloor.

Sampling of fish

Bottom dwelling flat fish (dab, *Limanda limanda* and flounder *Platichthys flesus*) were taken in focus, since they live on the seafloor and in close proximity to marine dumped munition. Previous studies found traces of munition compounds in bile of dab collected near the munition dump site Kolberger Heide in the Baltic Sea. Furthermore, elevated frequency of liver nodules (tumours) were observed in dab collected from Kolberger Heide. The present cruise aimed to investigate flat fish from the North Sea in areas around Helgoland, which are potentially polluted by MC.

Flatfish were attempted to be collected at Tiefe Rinne with beam trawls which was unsuccessful. But North West of Helgoland, the beam trawl was successfully used to collect flatfish. To reduce the amount of oyster

shells, which were highly abundant in the area and were collected with the beam trawl, the number of chains on the beam was reduced to a single chain. This reduced the amount of oyster shells clogging the net.

At Tiefe Rinne and Steingrund also angling was performed. At Tiefe Rinne high water depth >50m in combination with tidal current, permitted that the baited hooks reached the seafloor and no fish was caught at Tiefe Rinne. At Steingrund approx. 20m depth, angling was successful for round fish (mackerel, whiting, cod).

Collected fish were reared in tanks with sea water supply on ship, until sampling. Fish were killed with an overdose of clove oil inspected for externally visible diseases, and measured for weight and length. Body fluids (blood, bile, urine) and tissue samples (liver, spleen, muscle) were collected and stored frozen for later laboratory analysis.

Narrative and Preliminary results

The cruise started Monday August 29th at lunch time and Helgoland harbour was reached in the afternoon. On the next day Clupea steamed from Helgoland to Tiefe Rinne and after a CTD the 3 m beam trawl with a 40mm flatfish net was pulled for 15 min. During the trawl, the net was heavily damaged by oyster shells, which ripped the bottom part of the net apart. The crew started immediately to install the replacement net at the beam and during this time angling was performed by scientific staff members. Angling at Tiefe Rinne remained unsuccessful, with the fishing gear used, it was impossible to place the bait above ground, due to tidal current (3kn) above a water depth of 55m, string and bait were drifting up in the water column. Overall angling at Tiefe Rinne remained unsuccessful.

After the beam trawl net was replaced, we steamed to a position West from Helgoland, made another CTD and a 5min beam trawl which yielded again oyster shells, but no flat fish. In order to reduce the amount of collected oyster shells in the net, bottom driver chains except one were removed from the beam, which indeed resulted in lower amounts of oyster shells, but still did not yield flat fish.

On Wednesday August 13rd, we steamed to a position North West of Helgoland where after the CTD two trawls yielded dab, which were sampled. Further trawls were unsuccessful presumably due to the changed tidal current, which lifted up the beam. Elongation of the cord to the beam improved the Situation and more dab were caught and sampled.

On the next day, we returned to the same location and collected more dab, reaching a number of 32 dab sampled at the site. About 60% of the collected dab showed hyperpigmentation (Table 1), a melanoma of

the skin. Melanoma of dab are generally increasing in the North Sea, its causation is yet unknown. Other externally visible disease were in the range commonly observed in the region (table 1).

Later we steamed to Steingrund, a munition dumpsite east of Helgoland to perform angling and caught 6 mackerel, 2 cod and 2 whiting that were all sampled. These fish did not show any visible symptoms of disease.

Table 1. Externally visible diseases of common dab, *Limanda limanda*. Percent at the sampling site North-West of Helgoland.

Location:	N	Ly	EpPap	Ulc	AkHei	FloF	AkHei	KieHy	Mel	Skel	Steph	Acanth	Lepe	Cryp
HelgoNW	32	6.3	0	0	0	0	0	0	59.4	0	0	0	15.6	0
HelgoWSand	1	0	0	0	0	0	0	0	100	0	0	0	0	0
Sum N	33													

N = number of fish investigated, Ly = lymphocystis virus, EpPap = epidermal papilloma virus, FloF = bacterial fin rot (Flossenfäule), KieHy = gill hyperplasia, Mel = skin melanoma, Skel = skeletal deformations, Steph = *Stephanostomum baccatum*, Acanth = *Acanthochondria cornuta*, Lepe = *Lepeophtheirus pectoralis*, Cryp = *Cryptocotyle lingua*.

Participants

Name	Institution	Function
Jörn Peter Scharsack	TI-FI	Cruise leader
Tammo Cremer	TI-FI	Engineer
Michael Gabel	TI-FI	Scientist
Romina Schustter	AWI	Scientist
Annemie Doliwa	Uni-DUES	Scientist

Acknowledgements

Thanks to Captains Thorsten Köhn and FRV "Clupea" crew members for their excellent support and hospitality and to all participants for their reliable and responsible teamwork.